REMARKS/ARGUMENTS

This Amendment is intended to be a complete response to the Office Action of December 10, 2002 and the case is believed to be in condition for allowance. Accordingly, reconsideration is respectfully requested.

Status of the Claims

Claims 1-29 are pending in the Application. Claims 21-26 are allowed. Claims 1-3, 20 and 27 were rejected in the Office Action. Claims 4-19, 28 and 29 were objected to in the Office Action. Claims 30, 31, and 32 are added herein.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The first page of the attachment is captioned **"Version with markings to show changes made."**

The Claims

35 USC 102

Claims 1-3, 20 and 27 were rejected under 35 USC 102(b) as being anticipated by Gardner et al. (U.S. Patent No. 5,365, 229). Applicants traverse the rejection.

"A rejection for anticipation under section 102 requires that each and every limitation of the claimed invention be disclosed in a single prior art reference." In re Paulsen, 30 F.3d 1475, 1478 (Fed. Cir. 1994). Such is not the case here.

For example, Claim 1 recites "having a logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies." Applicants have reviewed Gardner and find no teaching of transmission on a plurality of carrier frequencies. The Examiner has pointed to Col. 1, lines 33-40 and Col. 3, lines 10-15 for that teaching. The first cited passage deals with multilevel data-coding and the second discusses encoding and modulation. The Examiner asserts, erroneously, that "multilevel data coding requires multilevel signals which can require multi-carrier modulation."

Multilevel data coding and multilevel signals merely refer to encoding an alphabet of symbols by manipulating a signal to multiple levels. For example, while a binary alphabet would be encoded using two voltage levels, a quadrinary alphabet could be encoded using four voltage levels. QAM is an example of multilevel encoding combined with phase shift. In QAM an alphabet is encoded by assigning certain amplitudes and phase shift to each symbol. (See for example, Tanenbaum, Computer Networks, page 73 and Figure 2-12, excerpt provided.) Thus, multilevel has nothing to do with using a plurality of carrier frequencies.

Multilevel data coding and multilevel signals may be implemented on a single carrier frequency. Thus, Gardner's discussion of multilevel data coding and multilevel signals is not a teaching of "having a logic operable to cause transmission ... on a plurality of carrier frequencies."

Furthermore, Gardner clearly had one carrier frequency in mind. First, this is explicitly stated: "The serial data is first encoded to reshape the signal's base band frequency spectrum then modulated into **the desired uplink frequency band.**" Gardner, Col. 3, lines 12-15 (emphasis added). Gardner used the **singular** to describe the target frequency. Second, Gardner describes combining a carrier signal with a phase-shifted carrier signal (see, Fig. 15). If these two carrier signals were at different frequencies, the concept of phase shifting would make no sense. Simply speaking, it would not be possible to combine the two carriers as shown in Fig. 15 if the carrier and the phase-shifted carrier were not at the same frequency.

Thus, Gardner does not anticipate Claim 1.

The other independent claims recite analogous limitations to Claim 1 and are therefore also not anticipated by Gardner for the reasons given in support of Claim 1. The various dependent claims rejected as anticipated by Gardner incorporate the limitations of their respective base claims, provide further unique limitations and are

therefore patentable for the reasons given in support of their respective base claims and by virtue of such further limitations.

Accordingly, Applicants respectfully request withdrawal of the rejection of Claims 1-3, 20 and 27.

Allowable Subject Matter

The Examiner has indicated that Claims 4-19, 28 and 29 would be allowable if rewritten in independent for including all of the limitations of the base claim and any intervening claims. In light of the argument above in support of the Claims 1-3, 20 and 27, Applicants, for the time being, decline to rewrite Claims 4-19, 28 and 29 as suggested.

Applicants thank the Examiner for indicating that Claims 21-26 are allowable over prior art.

The Drawings

The Examiner stated in the Office Action that Figure 1 should be designated by a legend such a "Prior Art" because that which is old is illustrated. Applicants herewith submit a proposed drawing amendment for approval by the Examiner. Enclosed is a copy of Figure 1 marked up to indicate the change.

CONCLUSION

It is submitted that all the claims now in the application are allowable. Applicants respectfully request reconsideration of the application and claims and its early allowance. If the Examiner believes that the prosecution of the application would be facilitated by a telephonic interview, Applicants invite the Examiner to contact the undersigned at the number given below.

The only fees believed to be due in connection with this Response are the additional claim fees as has been indicated on the transmittal letter. If Applicant is in

error as to these fees, the Commissioner is hereby authorized to charge any fees, which may be required, or credit any overpayment, to Deposit Account 19-0597.

Respectfully submitted,

Pehr B. Jansson
Registration No. 35,759

Date: January 23, 2003

Enclosures:
1. Version with Markings to Show Changes Made (1 page)
2. Excerpt from Tanenbaum, Computer Networks (8 pages)
3. Return Receipt Postcard
4. Transmittal Form (1 page)
5. Amendment Transmittal Letter (1 page) & duplicate copy
6. Proposed Drawing Amendment for Approval by Examiner (1 page)
7. Marked up copy of Figure 1 showing change (1 sheet)

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the specification:

Paragraph beginning at line 17 of page 4 has been amended as follows:

Another aspect of the present invention is a method of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable. According to the method, the well-logging telemetry system is operated to execute the steps of modulating a bit stream onto a plurality of carrier frequencies; transmitting the modulated bit stream on a first propagation mode from the downhole telemetry cartridge to the uphole telemetry unit; and operating the uphole telemetry unit to demodulate the received bitstream.

In the claims:

The following claims have been added the application:

--30. The telemetry system of Claim 1, wherein the wireline cable is a heptacable.--

--31. The method of Claim 21, wherein the wireline cable is a heptacable.--

--32. The method of Claim 27, wherein the wireline cable is a heptacable.--

COMPUTER NETWORKS

SECOND EDITION

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switching centers, called **toll offices** (or **tandem offices**). These lines are called **toll connecting trunks**. If both the caller's and callee's end offices happen to have a toll connecting trunk to the same toll office (a likely occurrence if they are relatively close by), the connection may be established within the toll office. A telephone network consisting only of end offices (the large dots) and toll offices (the squares) is shown in Fig. 2-9(c).

If the caller and callee do not have a toll office in common, the path will have to be established somewhere higher up in the hierarchy. There are sectional and regional offices that form a network by which the toll offices are connected. The toll, sectional, and regional exchanges communicate with each other via high bandwidth **intertoll trunks**. The number of different kinds of switching centers and their topology (e.g., may two sectional offices have a direct connection or must they go through a regional office?) varies from country to country depending on its telephone density. Figure 2-10 shows how a medium-distance connection might be routed.

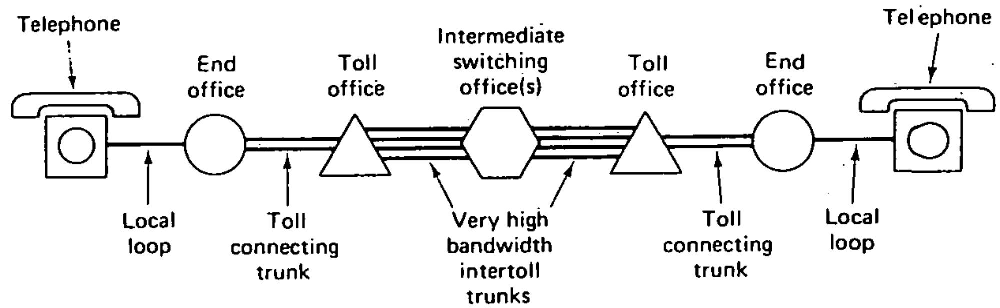

Fig. 2-10. Typical circuit route for a medium-distance call.

A variety of transmission media are used for telecommunications. Local loops consist of pairs of insulated copper wires nowadays, although at the beginning of the century, uninsulated wires spaced 25 cm apart on telephone poles were common. Between switching offices, coaxial cables, microwaves, and waveguides are used. Fiber-optics systems using lasers are also becoming more widespread, primarily because their enormous bandwidth allows a single bundle to replace many copper cables, alleviating the critical overcrowding within existing cable ducts.

2.3.2. Modems

The local loop consists of a pair of copper wires running between the subscriber's telephone and an end office. If it were not for the difficulties mentioned below, such a conductor could carry traffic at 1 or 2 Mbps without any trouble. The signals used on the local loop are dc, limited by filters to the frequency range 300 Hz to 3kHz. If a digital signal were to be applied to one end of the line, the received signal at the other end would not show a square wave form, owing to

capacitance and inductance effects. Rather it would rise slowly and decay slowly. This effect makes baseband (dc) signaling unsuitable except at slow speeds and over short distances. The variation of signal propagation speed with frequency also contributes to the distortion.

To get around the problems associated with dc signaling, ac signaling is used. A continuous tone in the 1000 to 2000 Hz range is introduced, called a **sine wave carrier**. Its amplitude, frequency, or phase can be modulated to transmit information. In **amplitude modulation**, two different voltage levels are used to represent 0 and 1, respectively. In **frequency modulation**, also known as **frequency shift keying**, two (or more) different tones are used. In the most common form of **phase modulation**, the carrier wave is systematically shifted 45, 135, 225, or 315 degrees at uniformly spaced intervals. Each phase shift transmits 2 bits of information. Figure 2-11 illustrates the three forms of modulation. A device that accepts a serial stream of bits as input and produces a modulated carrier as output (or vice versa) is called a **modem** (for modulator-demodulator). The modem is inserted between the (digital) computer and the (analog) telephone system.

Some advanced modems use a combination of modulation techniques. In Fig. 2-12(a), we see dots at 0, 90, 180, and 270 degrees, with two amplitude levels per phase shift. Amplitude is indicated by the distance from the origin. In Fig. 2-12(b) we see a different modulation scheme, in which 30-degree phase shifts are used. Eight of the phase shifts can have only one legal amplitude, but the other four have two possible values, allowing for 16 combinations in all. Thus Fig. 2-12(a) can be used to transmit 3 bits per baud and Fig. 2-12(b) can be used to transmit 4 bits per baud. The scheme of Fig. 2-12(b) when used to transmit 9600 bps over a 2400-baud line is called **QAM (Quadrature Amplitude Modulation)**.

At the junction between the local loop, which is (usually) a two-wire circuit, and the trunk, which is a four-wire circuit, echoes can occur. As an illustration of electromagnetic echoes, try shining a flashlight from a darkened room through a closed window at night. You will see a reflection of the flashlight in the window (i.e., some of the energy has been reflected at the air-glass junction and sent back toward you). The same thing happens in the end office.

The effect of the echo is that a person speaking on the telephone hears his own words after a short delay. Psychological studies have shown that this is annoying to many people, often making them stutter or become confused. To eliminate the problem of echoes, echo suppressors are installed on lines longer than 2000 km. (On short lines the echoes come back so fast that people cannot detect them.) An **echo suppressor** is a device that detects human speech coming from one end of the connection and suppresses all signals going the other way.

When the first person stops talking and the second begins, the echo suppressor switches directions. While it is functioning, however, information can only travel in one direction. Figure 2-13(a) shows the state of the echo suppressors while A is talking to B. Figure 2-13(b) shows the state after B has started talking. When echo suppressors are used, full-duplex communication is impossible.

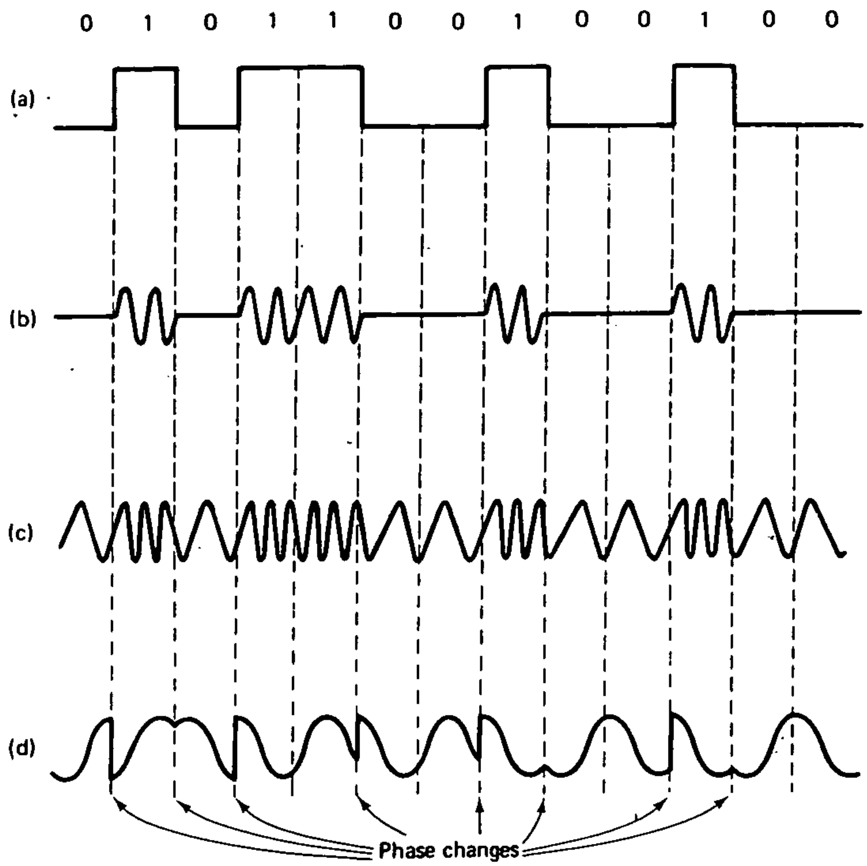

Fig. 2-11. (a) A binary signal. (b) Amplitude modulation. (c) Frequency modulation. (d) Phase modulation.

The echo suppressors have several properties that are undesirable for data communication. First, they prevent full-duplex data transmission, which would otherwise be possible, even over the two-wire local loop (by allocating part of the bandwidth to the forward channel and part to the reverse channel). Even if half-duplex transmission is adequate, they are a nuisance because the time required to switch directions can be substantial. Furthermore, they are designed to reverse upon detecting human speech, not digital data.

To alleviate these problems, an escape hatch has been provided. When the echo suppressors hear a pure tone at 2100 Hz, they shut down, and remain shut down as long as a carrier is present. This arrangement is one of the many examples of **in-band signaling**, so called because the control signals that activate and deactivate internal control functions lie within the band accessible to the user.

In recent years a new form of local distribution has appeared on the horizon: cable tv. Since a television channel requires 6 MHz of bandwidth and most cable systems offer many channels, typically cables with a bandwidth of 300 MHz are

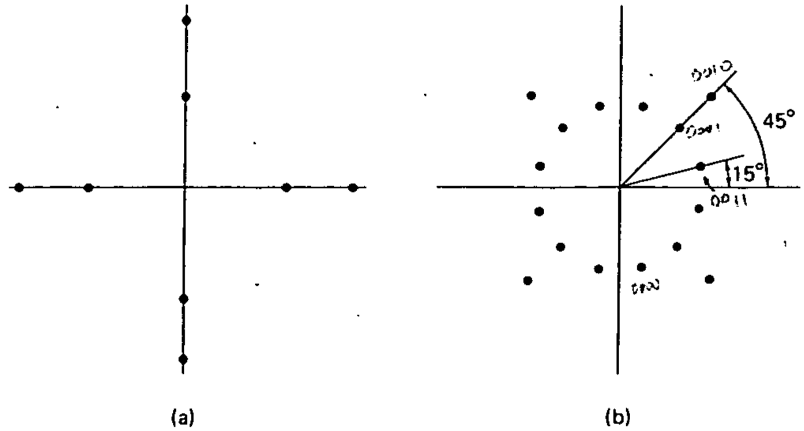

Fig. 2-12. (a) 3 bits/baud modulation. (b) 4 bits/baud modulation.

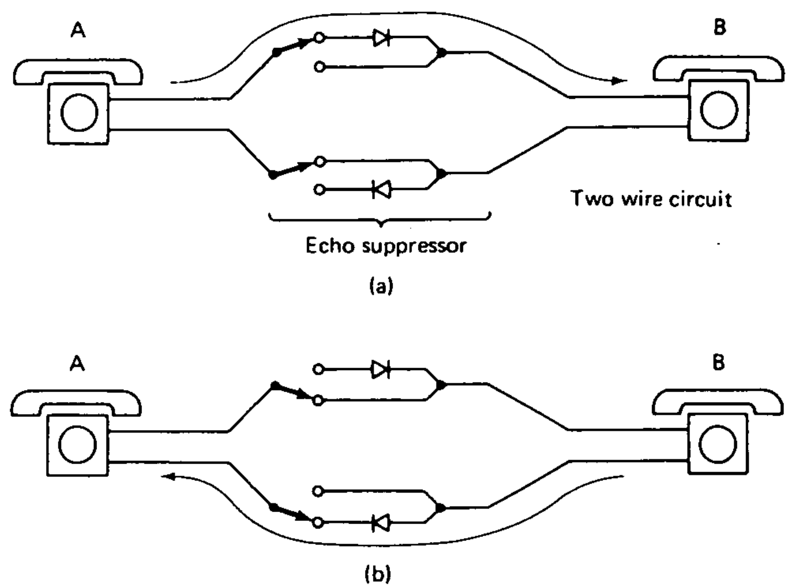

Fig. 2-13. (a) *A* talking to *B*. (b) *B* talking to *A*.

used. It bears watching in the future as a possible data transmission facility. Unlike the local loops, cable TV does not use a star pattern radiating out from an end office. Instead, everyone in the same neighborhood shares the same cable, which is like having hundreds of extension telephones on a single outgoing line. Nevertheless, high-performance data transmission systems can be built using a shared cable. In Chapter 3 we will see how multiple users can share a single channel in a fair and efficient way.

2.3.3. RS-232-C and RS-449

The interface between the computer or terminal and the modem is an example of a physical layer protocol. It must specify in detail the mechanical, electrical, functional, and procedural interface. In this section we will look closely at two well-known physical layer standards: RS-232-C and its successor, RS-449.

Let us start with **RS-232-C**, the third revision of the original RS-232 standard. The standard was drawn up by the Electronic Industries Association, a trade organization of electronics manufacturers, and is properly referred to as EIA RS-232-C. The international version is given in CCITT recommendation **V.24**, which is similar, but differs slightly on some of the rarely used circuits. In the standards, the terminal or computer is officially called a **DTE (Data Terminal Equipment)** and the modem is officially called a **DCE (Data Circuit-Terminating Equipment)**.

The mechanical specification is for a 25 pin connector 47.04 ± .13 mm wide (screw center to screw center), with all the other dimensions equally well specified. The top row has pins numbered 1 to 13 (left to right); the bottom row has pins numbered 14 to 25 (also left to right).

The electrical specification for RS-232-C is that a voltage more negative than −3 volts is a binary 1 and a voltage more positive than +4 volts is a binary 0. Data rates up to 20 kbps are permitted, as are cables up to 15 meters.

The functional specification tells which circuits are connected to each of the 25 pins, and what they mean. Figure 2-14 shows 9 pins that are nearly always implemented. The remaining ones are frequently omitted. When the terminal or computer is powered up, it asserts (i.e., sets to a logical 1) Data Terminal Ready (pin 20). When the modem is powered up it asserts Data Set Ready (pin 6). When the modem detects a carrier on the telephone line, it asserts Carrier Detect (pin 8). Request to Send (pin 4) indicates that the terminal wants to send data. Clear to Send (pin 5) means that the modem is prepared to accept data. Data is transmitted on the Transmit circuit (pin 2) and received on the Receive circuit (pin 3).

Other circuits are provided for selecting the data rate, testing the modem, clocking the data, detecting ringing signals, and sending data in the reverse direction on a secondary channel. They are hardly ever used in practice.

The procedural specification is the protocol, that is, the legal sequence of events. The protocol is based on action-reaction pairs. When the terminal asserts Request to Send, for example, the modem replies with Clear to Send, if it is able to accept data. Similar action-reaction pairs exist for other circuits as well.

It commonly occurs that two computers must be connected using RS-232-C. Since neither one is a modem, there is an interface problem. This problem is solved by connecting them with a device called a **null modem**, which connects the transmit line of one machine to the receive line of the other. It also crosses some of the other lines in a similar way.

RS-232-C has been around for years. Gradually, the limitation of the data rate

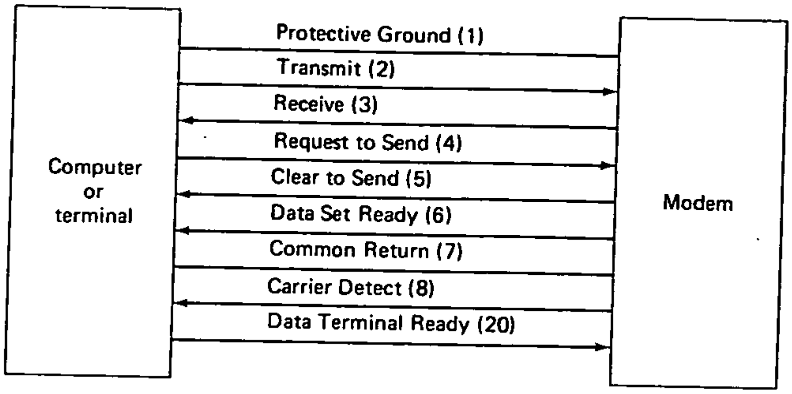

Fig. 2-14. Some of the principal RS-232-C circuits. The pin numbers are given in parentheses.

to not more than 20 kbps and the 15 meter maximum cable length have become increasingly annoying. EIA had a long debate about whether to try to have a new standard that was compatible with the old one (but technically not very advanced) or a new and incompatible one that would meet all needs for years to come. They eventually compromised by choosing both.

The new standard, called **RS-449**, is actually three standards in one. The mechanical, functional, and procedural interfaces are given in RS-449, but the electrical interface is given by two different standards. The first of these, **RS-423-A**, is similar to RS-232-C in that all its circuits share a common ground. This technique is called **unbalanced transmission**. The second electrical standard, **RS-422-A**, in contrast, uses **balanced transmission**, in which each of the main circuits requires two wires, with no common ground. As a result, RS-422-A can be used at speeds up to 2 Mbps over 60 meter cables, and at even higher speeds over shorter cables.

The circuits used in RS-449 are shown in Fig. 2-15. Several new circuits not present in RS-232-C have been added. In particular, circuits for testing the modem both locally and remotely were included. Due to the inclusion of a number of 2 wire circuits (when RS-422-A is used), more pins are needed in the new standard, so the familiar 25 pin connector was dropped. In its place is a 37 pin connector and a 9 pin connector. The 9 pin connector is only required if the second (reverse) channel is being used. If it is not being used, the 37 pin connector is sufficient.

2.4. DIGITAL TRANSMISSION

Historically, analog transmission has dominated the telecommunication industry since its inception. Signals have been sent by having some physical quantity (e.g., voltage) continuously vary as a function of time. With the advent of digital